**Week 2 Report Summer Internship**

Name: Mohamed Elfaki

University: Eastern Mediterranean University (Famagusta, Cyprus)

Department: Software Engineering

Training Organization: Cloud Solutions for IT & Communications Co, AI department

**Outline:**

1. Introduction
2. Decision trees implementation and analysis
3. Machine Learning Fundamentals revision
4. Introduction to Neural Networks
5. References
6. **Introduction**

This week’s goals are to understand decision trees all their equations and their purpose. Then to implement them from scratch using python without any scikit-learn libraries for maximum learning benefit. I will then revise the machine learning fundamentals I covered in the previous report. Finally, I will introduce myself to neural networks, the difference between traditional programming and ML in addition to understanding nodes, layers and connections.

1. **Decision trees implementation and analysis**

One of many ML algorithms that aims to emulate human intelligence is a decision tree. It is one of the more literal and logical ML algorithms, which follows a tree of questions until it reaches the leaf node (final answer). The system breaks down complex problems into many simple decisions and arrives at a conclusion.

I focused on implementing a decision tree that uses a dataset I got from Kaggle regarding red wine quality. The algorithm was made from scratch using no scikit-learn algorithms, first including an optimal split function that chooses based on Gini impurity. Each node makes decisions based on a feature’s best split.

At first, I used a method where I split by the mean, but later I realized this is not optimal as it doesn’t maximize information gain.

I learned how to think recursively better because of this implementation, although using libraries would’ve been easier this is a more valuable learning experience of the inner workings of this algorithm.

1. **Machine Learning Fundamentals Revision**

So far what I’ve covered in machine learning includes the basics of supervised, unsupervised and reinforcement learning. Although I’ve only implemented algorithms in supervised learning so far including linear regression, logistic regression and decision trees. In supervised learning the machine has training data along with the actual labels whereas in unsupervised learning there is only unlabelled data.

Linear regression serves to predict a feature based on other features in a numerical scale whereas logistic regression only gives a binary (yes/no) answer for classification problems. On the other hand decision trees can give both binary and numerical answer based on the averages of all the training examples.

Reinforcement learning which I’ve yet to work with involves giving the computer rewards for each correct prediction and punishments for incorrect ones.

1. **Introduction to Neural Networks**

A really important part of modern AI is neural networks. They are machine learning models that mimic the human brain’s function, they consist of, interconnected nodes that process data and learn patterns. This allows them to run tasks such as pattern recognition and decision making.

Neurons are the basic units in neural networks, connections are the links between these neurons and weights determine the strength of the connections.

Neural networks follow a 3 step process: input computation, output computation and iterative refinement. The layers within a neural network are the input layer, many hidden layers and the output layer.

1. **References**

<https://www.geeksforgeeks.org/machine-learning/neural-networks-a-beginners-guide/>

<https://www.ibm.com/think/topics/machine-learning>

<https://www.ibm.com/think/topics/decision-trees>